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Macy et al.

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(54) **DELIVERY SHELL USING GYROSCOPIC GUIDING SYSTEM AND METHODS OF MAKING THE SAME**

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(51) **Int. Cl.**

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F42B 12/40	(2006.01)
F42B 10/06	(2006.01)
F42B 8/16	(2006.01)
F41A 9/65	(2006.01)
F41B 11/55	(2013.01)

(52) **U.S. Cl.**

CPC . ***F42B 10/16*** (2013.01); ***F41A 9/65*** (2013.01); ***F41B 11/55*** (2013.01); ***F42B 8/16*** (2013.01); ***F42B 10/06*** (2013.01); ***F42B 12/40*** (2013.01)

(58) **Field of Classification Search**

CPC F42B 10/00; F42B 10/02; F42B 10/04; F42B 10/06; F42B 10/16; F42B 10/26; F42B 8/16; F42B 12/40

USPC 102/501, 502, 512, 513

See application file for complete search history.

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Primary Examiner — James S Bergin

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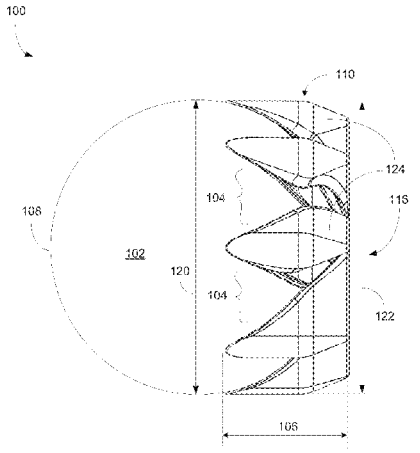
(57) **ABSTRACT**

A projectile such as a paintball including a ball-shaped capsule and a round-shaped disc capable of facilitating accuracy of projectile travel direction is disclosed. The ball-shaped or substantial ball-shaped capsule, in one embodiment, having a head and a tail is able to store and deliver colored markers upon an impact between the projectile and an object. The round-shaped disc is positioned at a place so that allowing a portion of the round-shaped disc to extend above outer surface of the capsule. The disc is able to catch at least airflow when the projectile is launched. The round-shaped disc, in one example, uses the direction of the airflow to facilitate travel direction of the projectile.

14 Claims, 20 Drawing Sheets



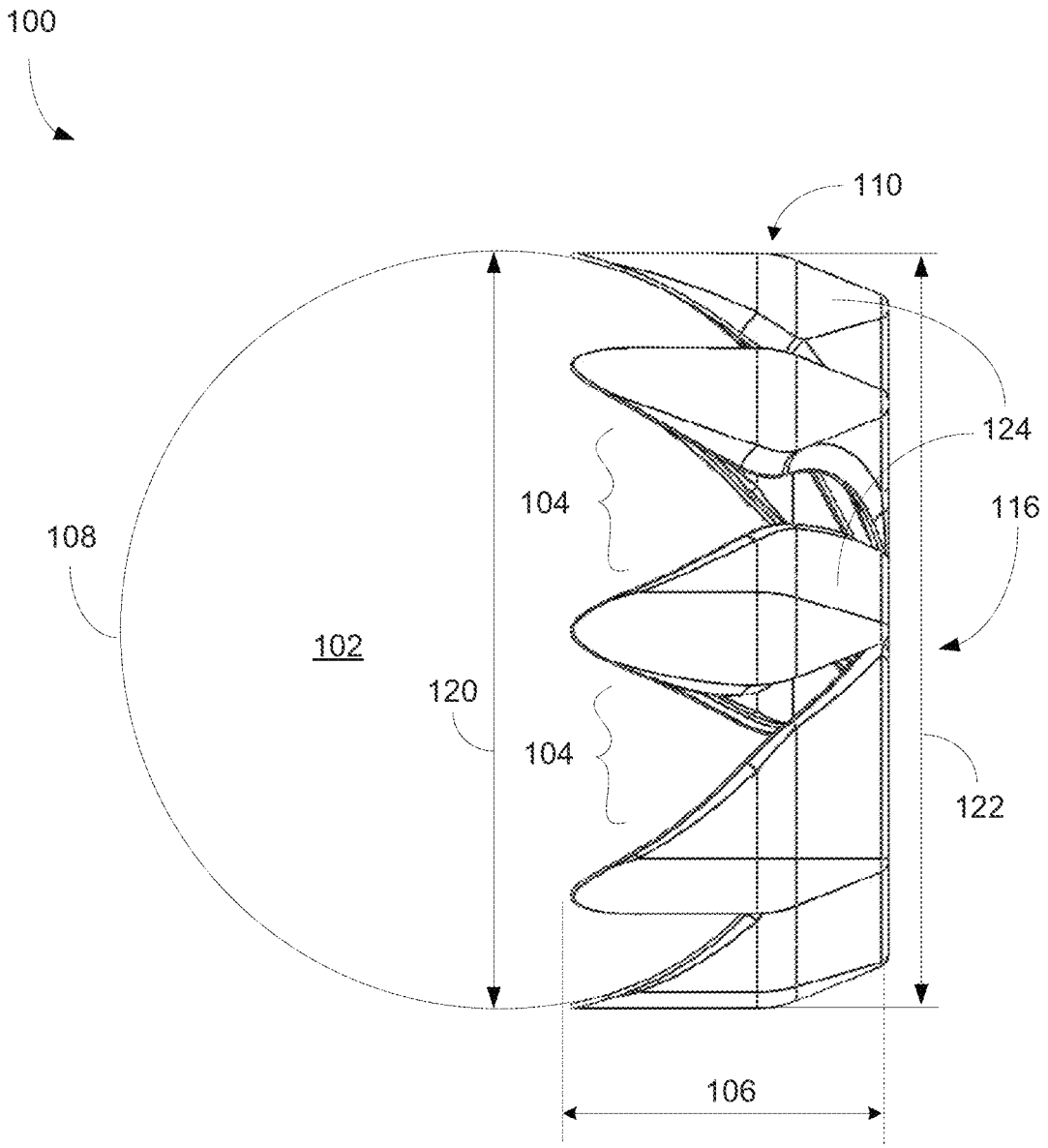


FIG 1A

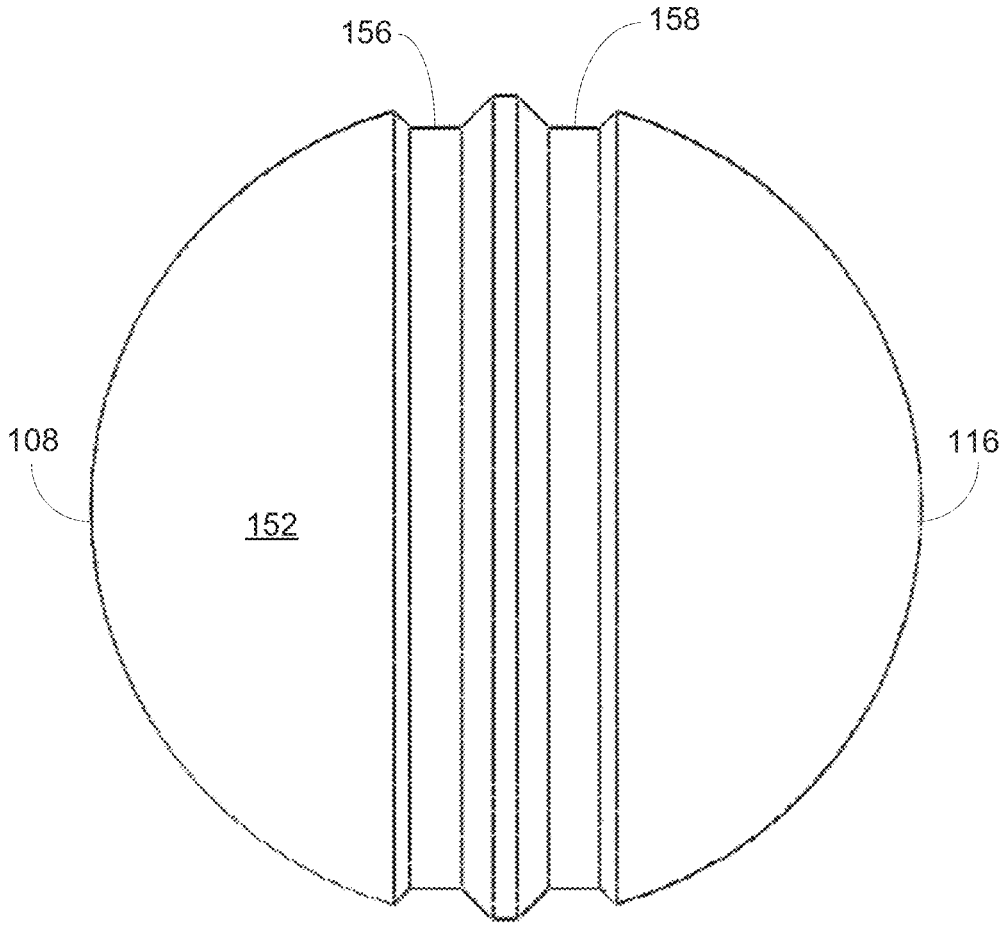


FIG. 1B

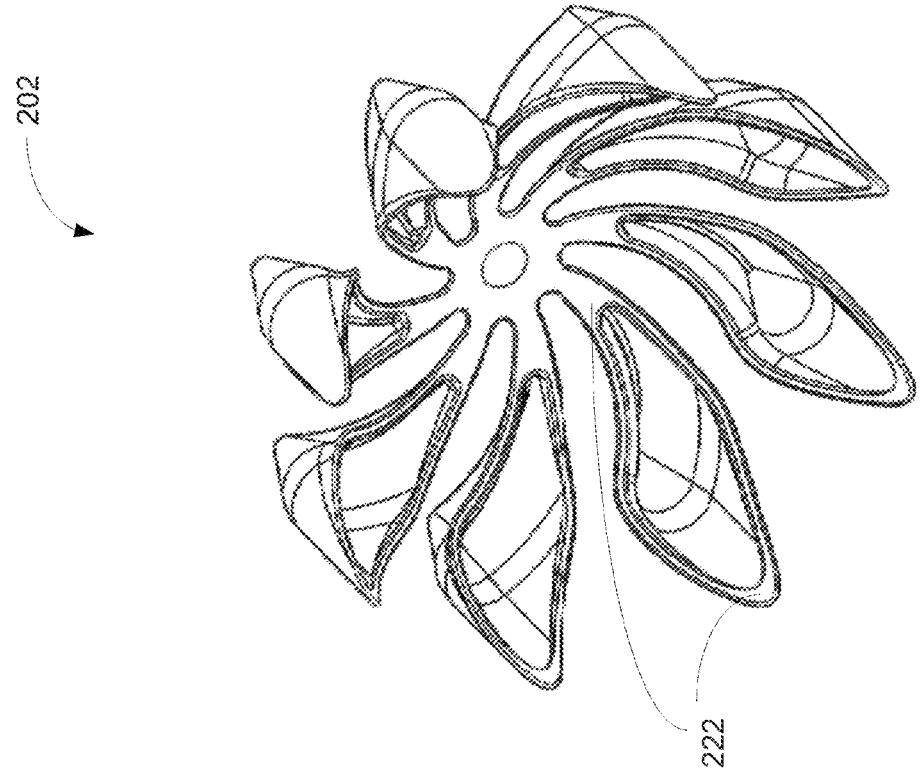


FIG 2B

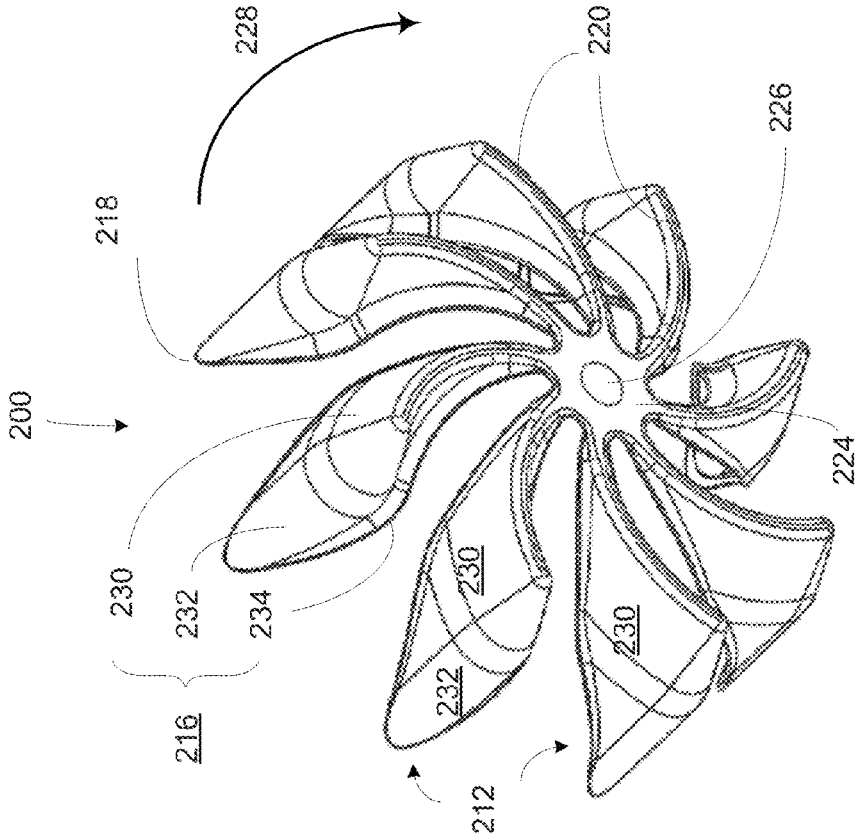


FIG 2A

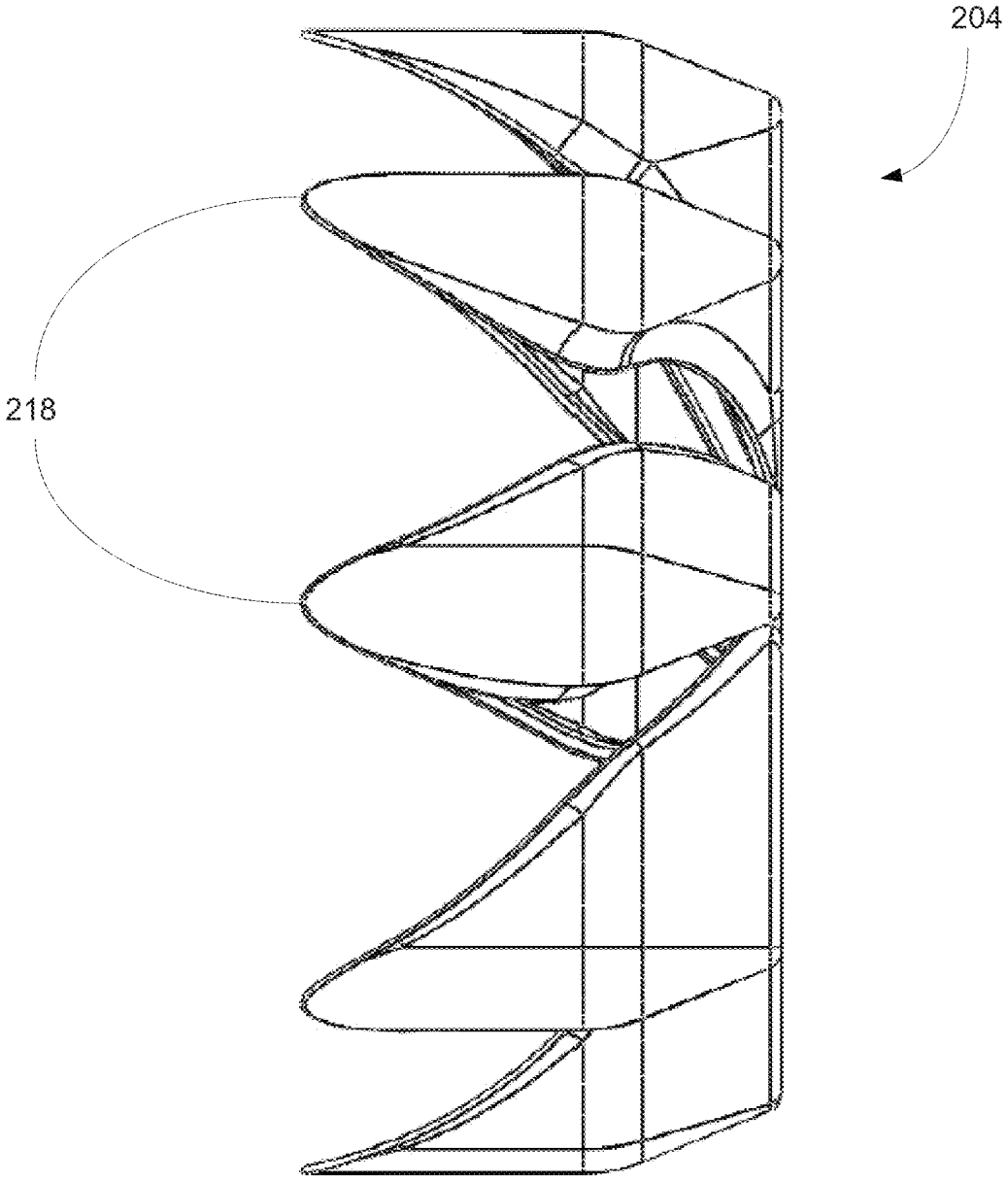
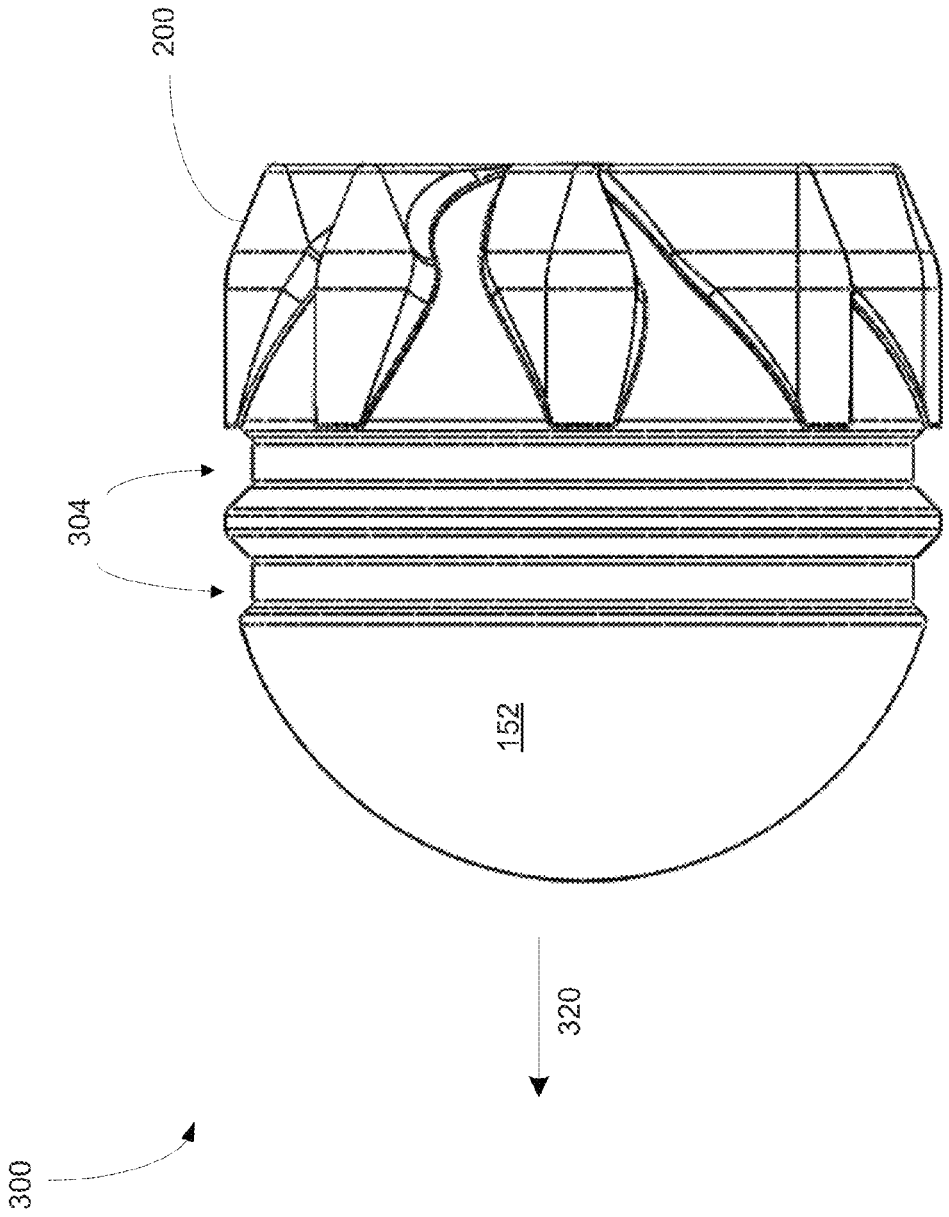


FIG. 2C

FIG 3



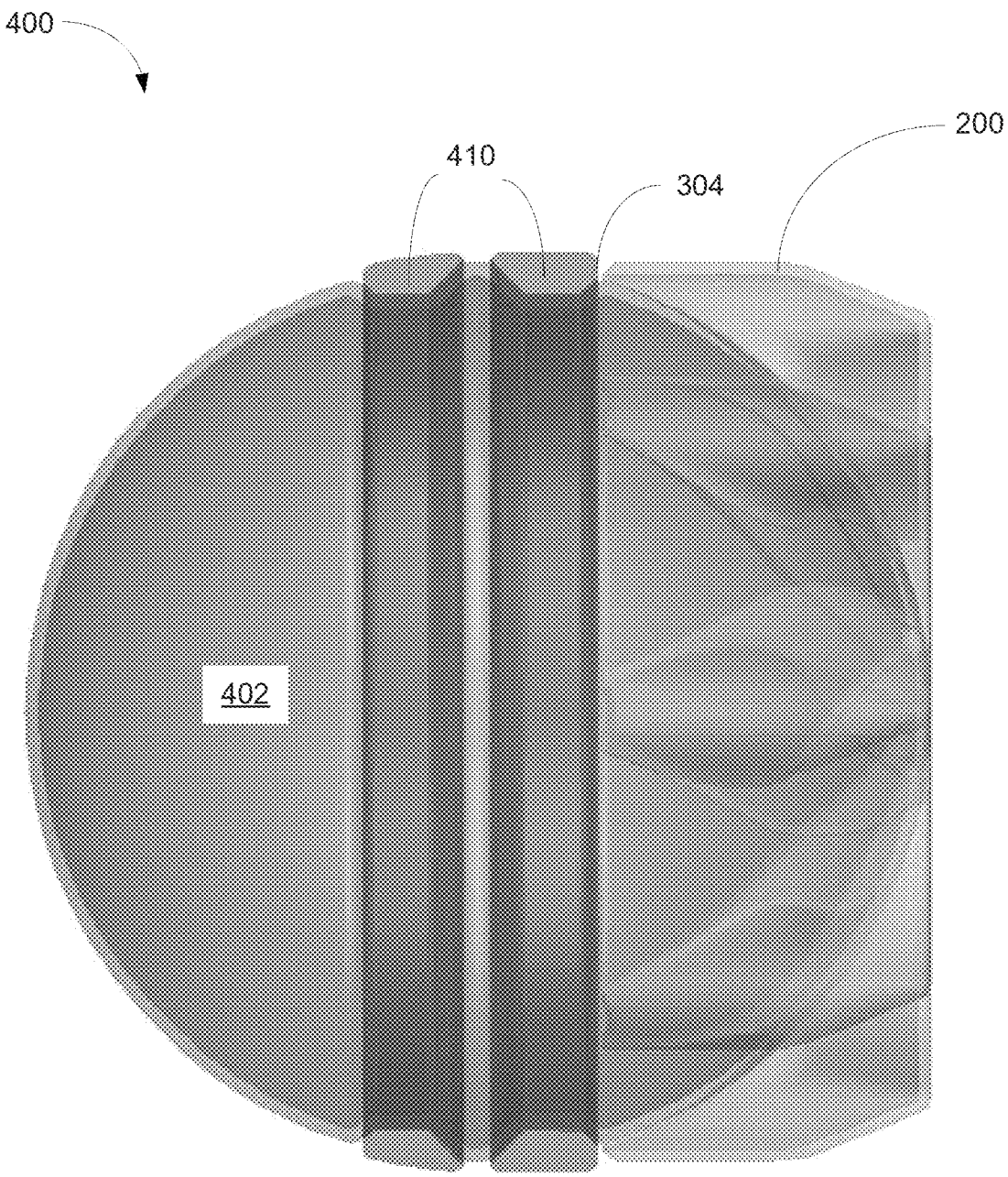


FIG 4A

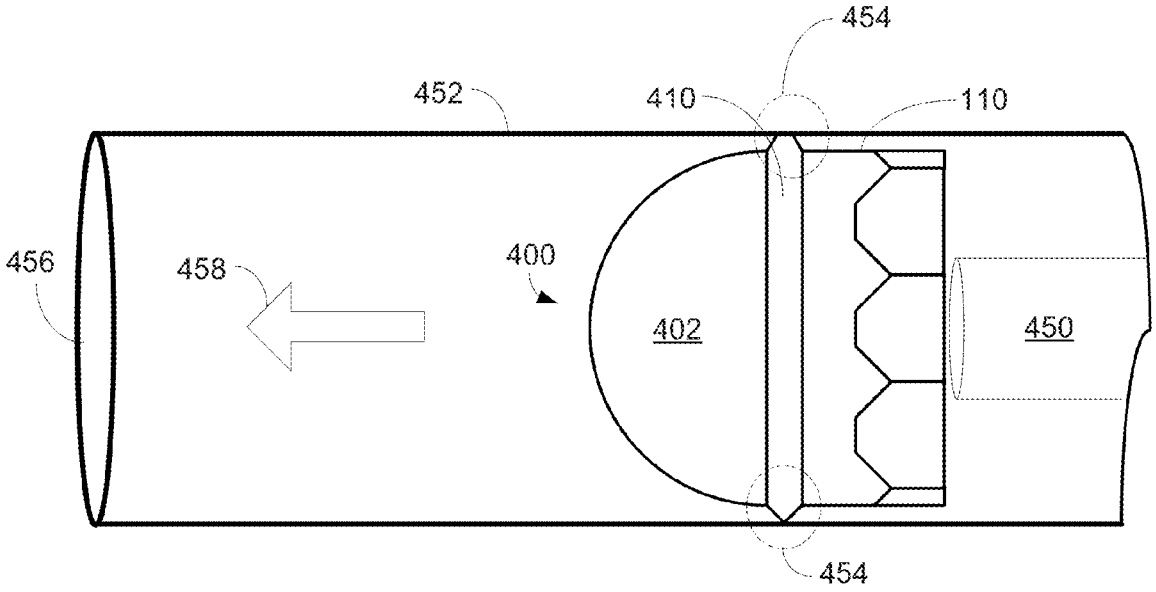

454
452
410
110
456
458
400
402
450
454

FIG. 4B

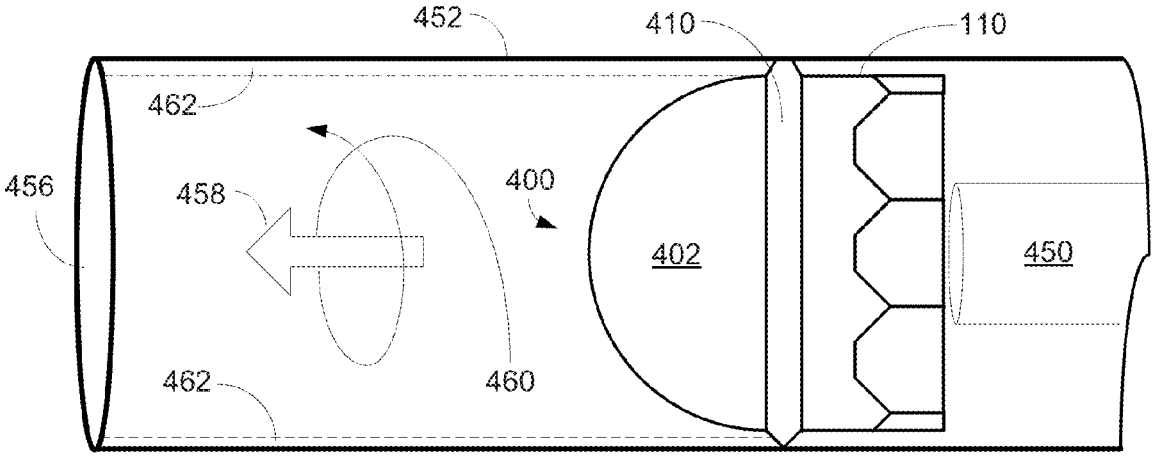

452
410
110
462
456
458
400
402
450
462
460

FIG. 4C

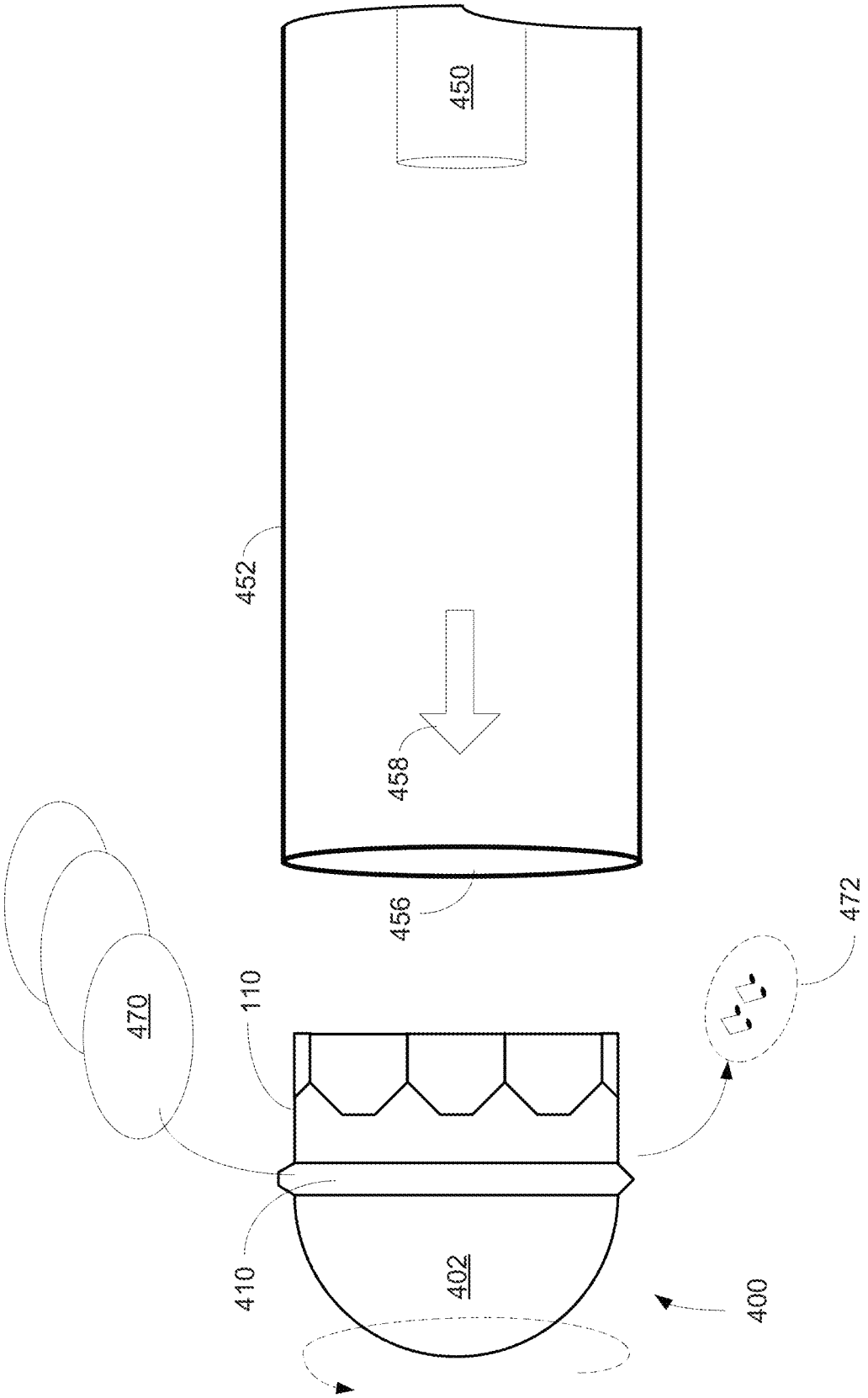


FIG. 4D

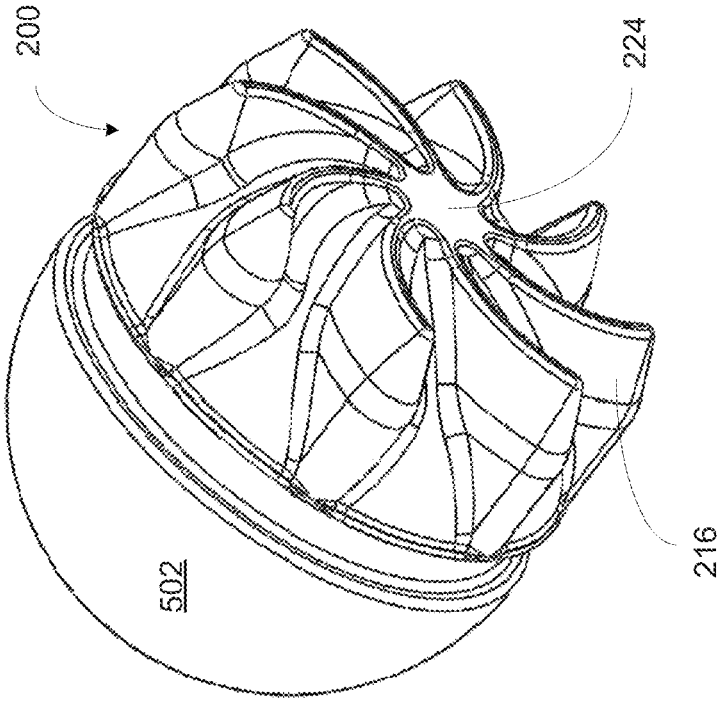


FIG 5B

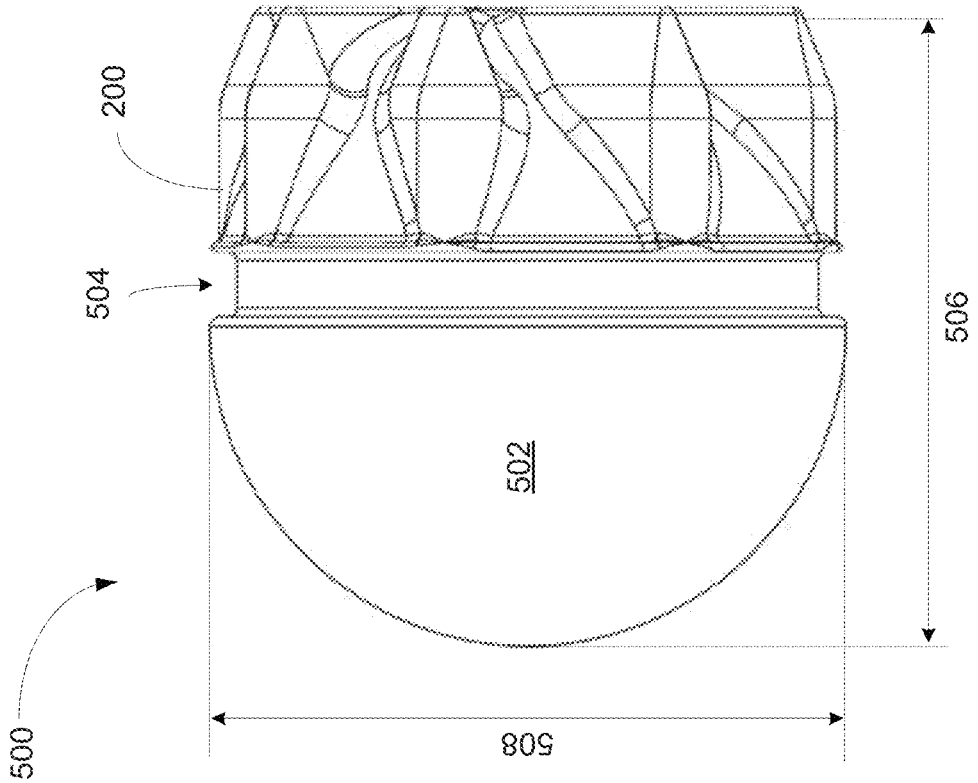


FIG 5A

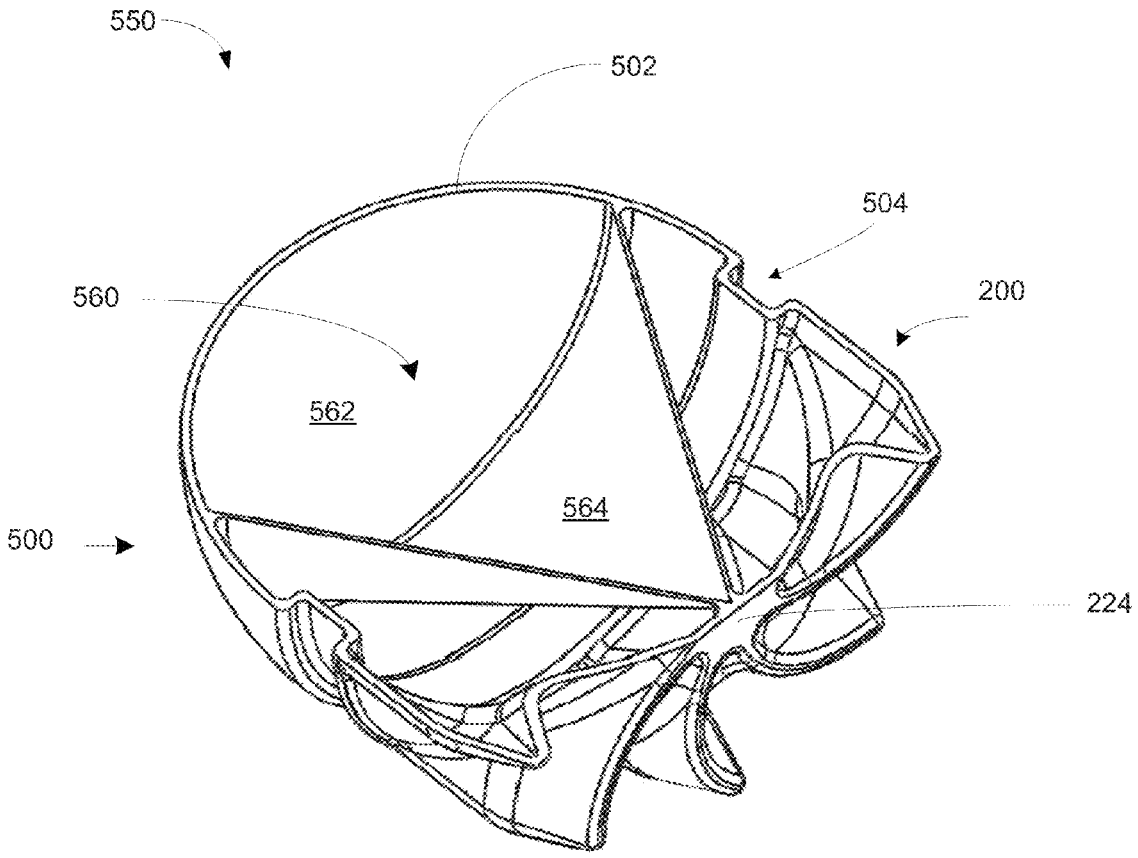


FIG 5C

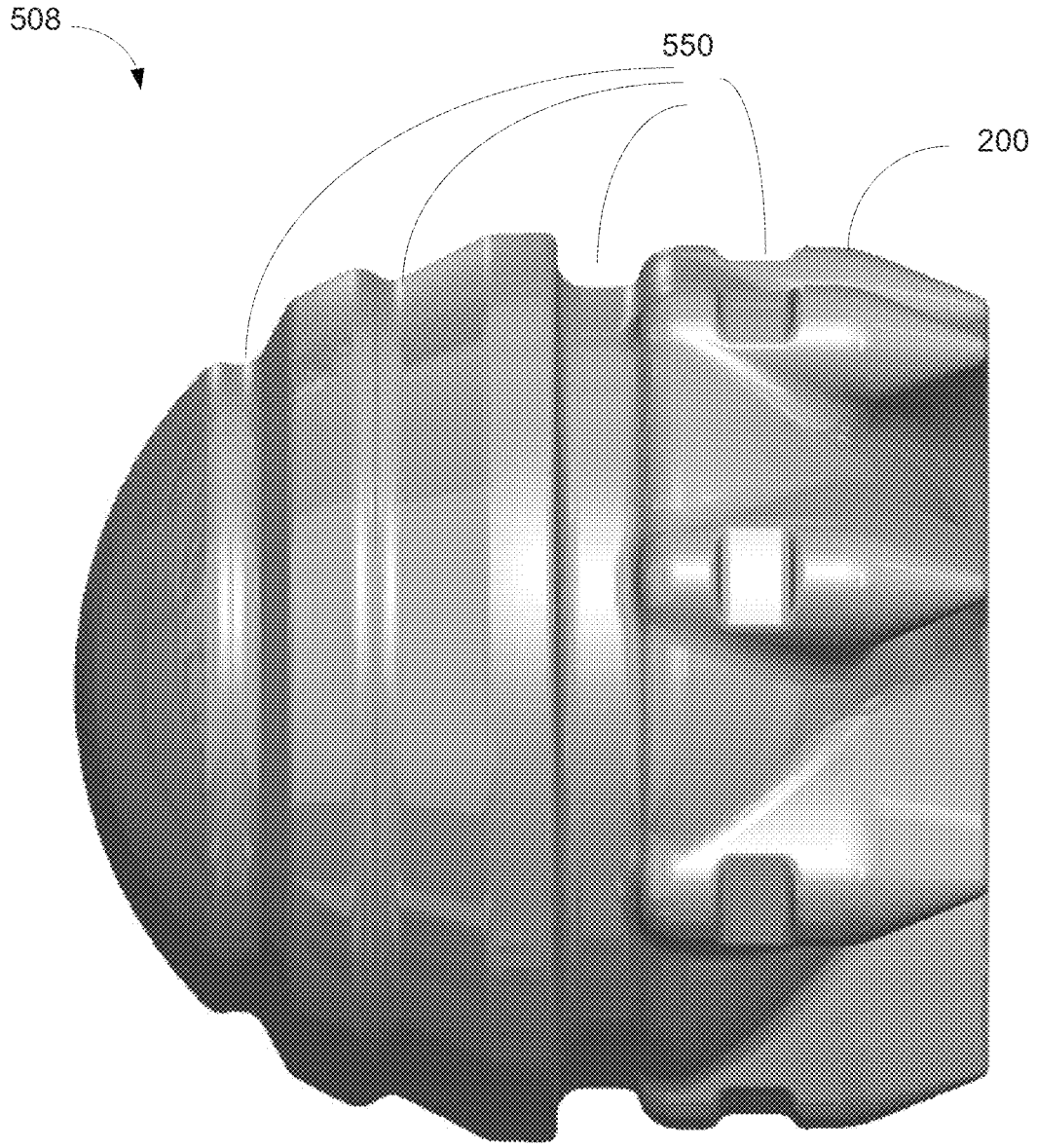


FIG 5D

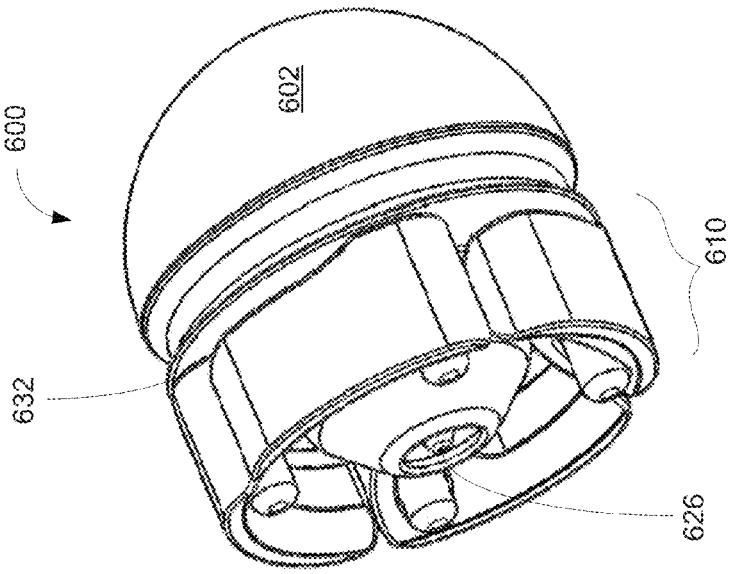

600
602
610
632
626

FIG 6B

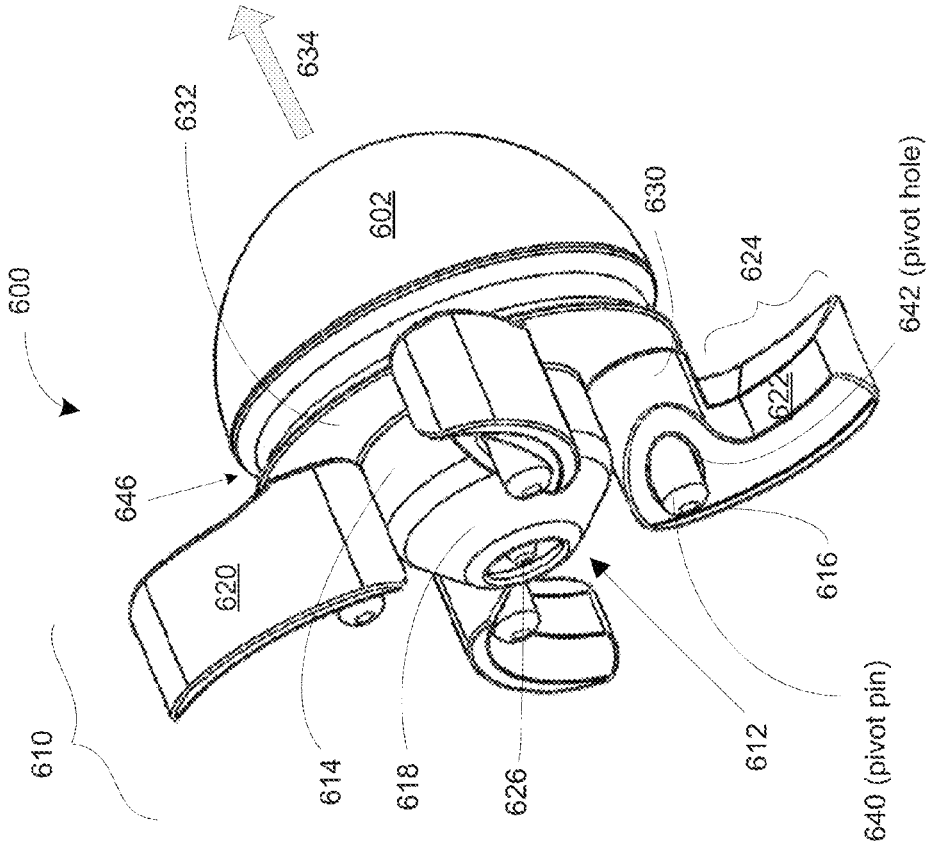

600
634
632
602
630
624
642 (pivot hole)
646
620
622
616
610
614
618
626
612
640 (pivot pin)

FIG 6A

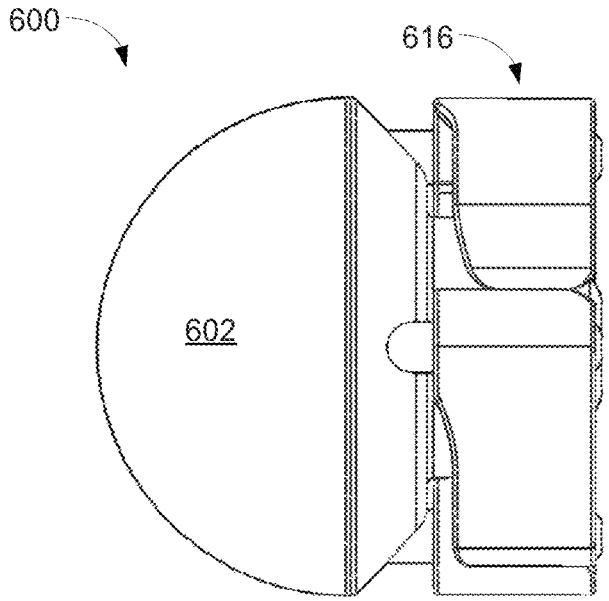


FIG 6C

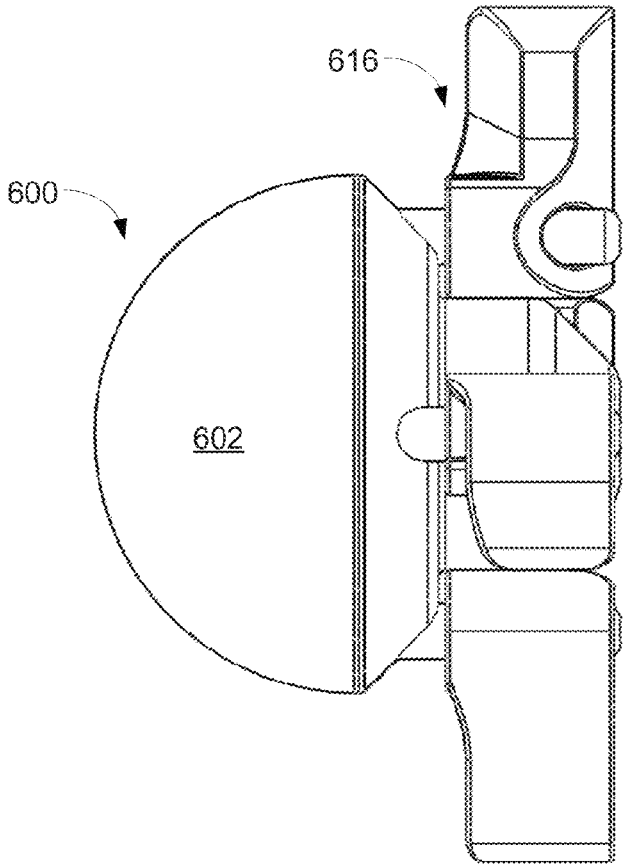


FIG 6D

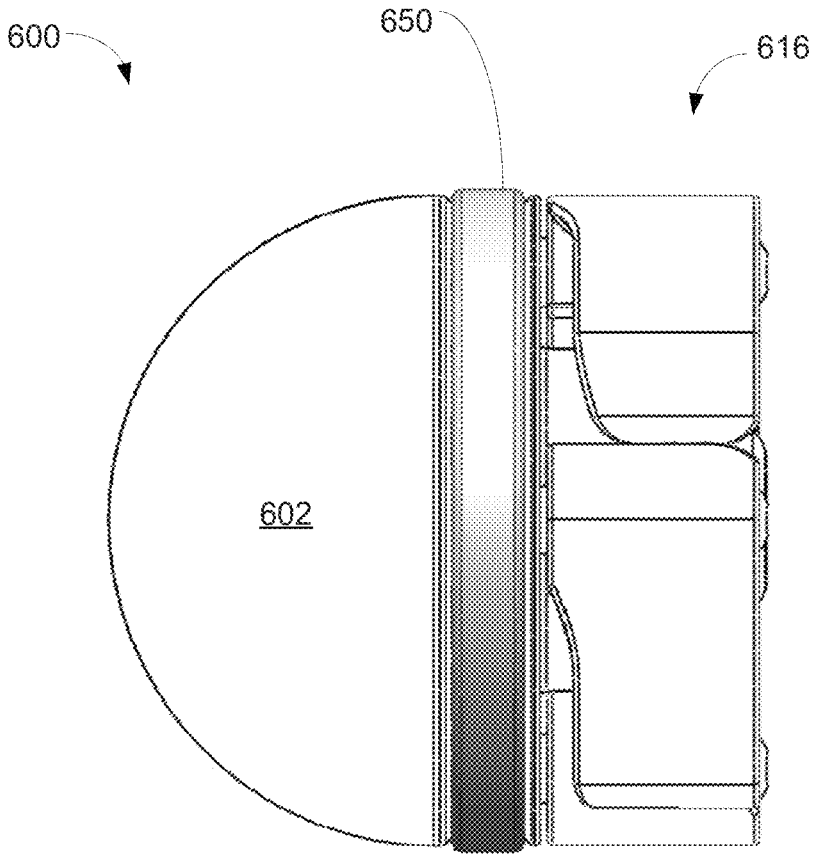


FIG 6E

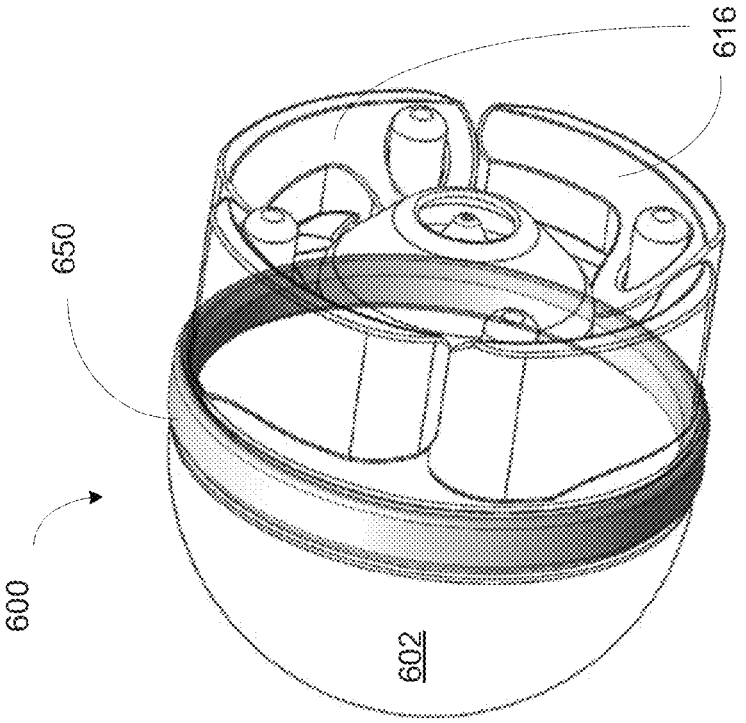


FIG 6F

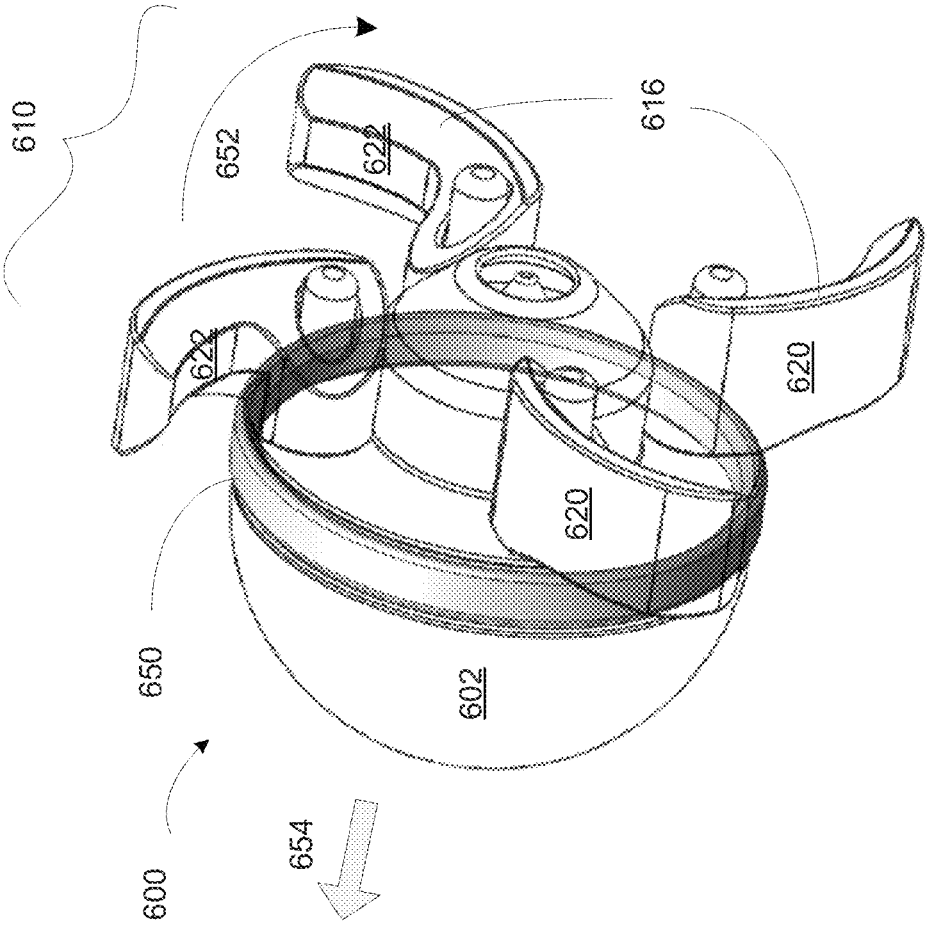


FIG 6G

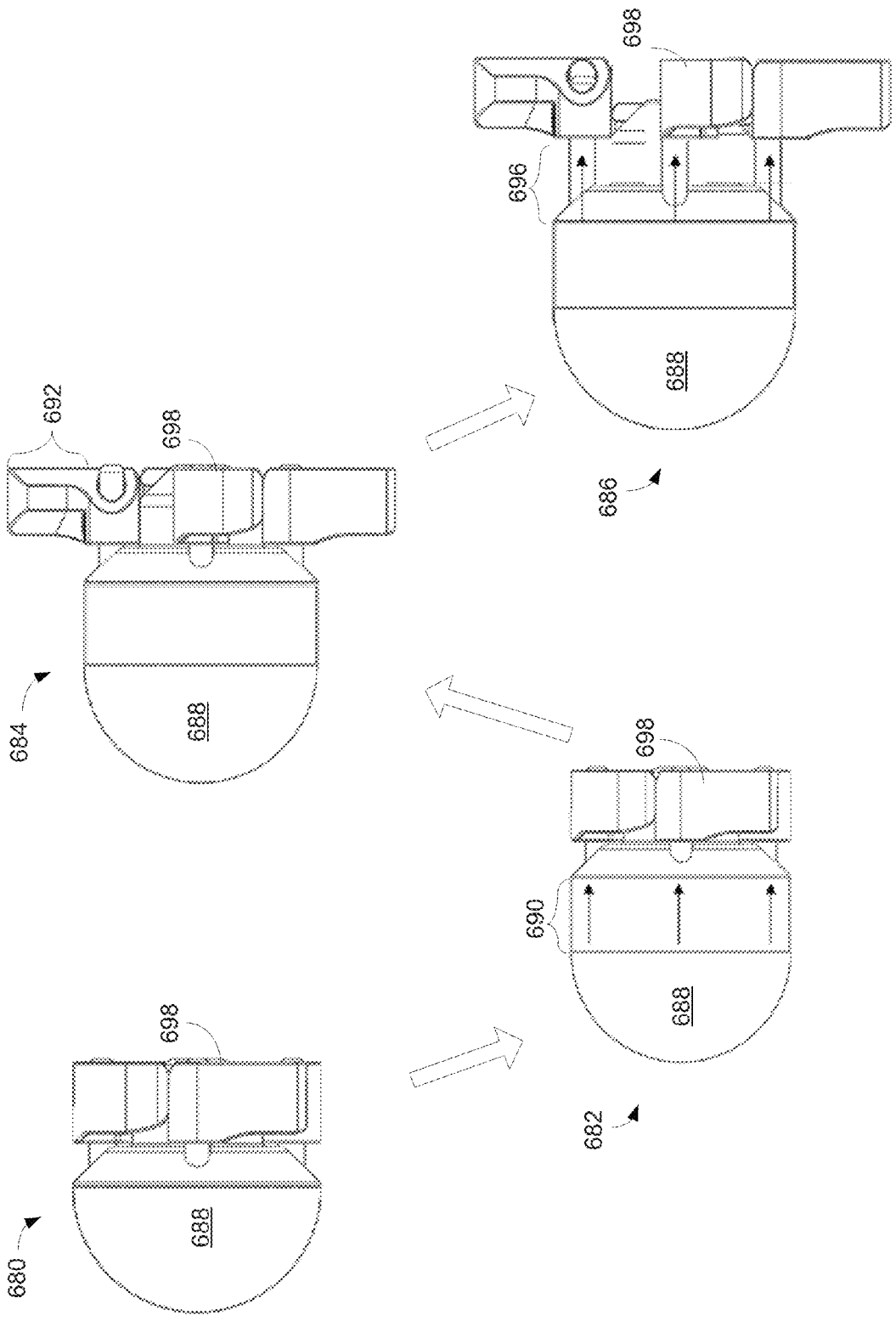


FIG 6H

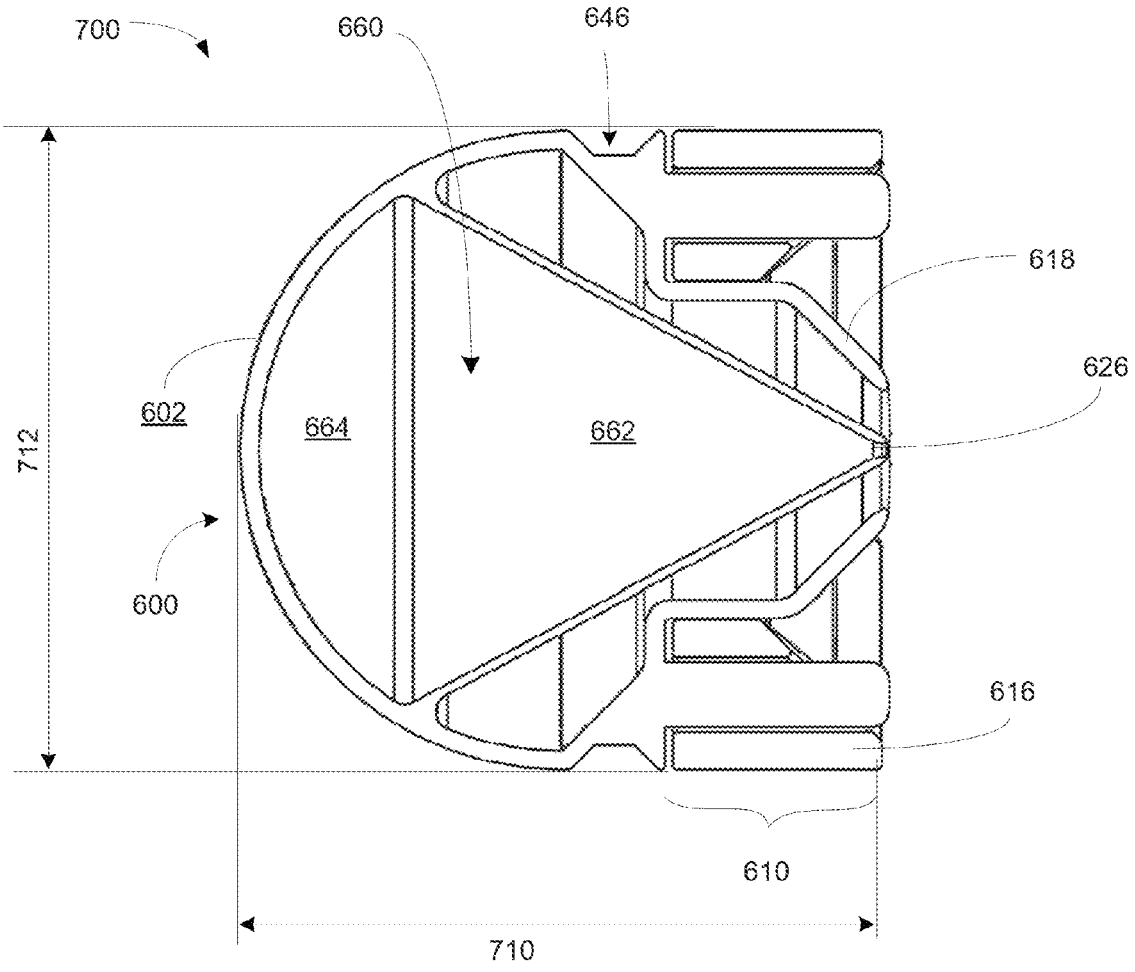


FIG 7

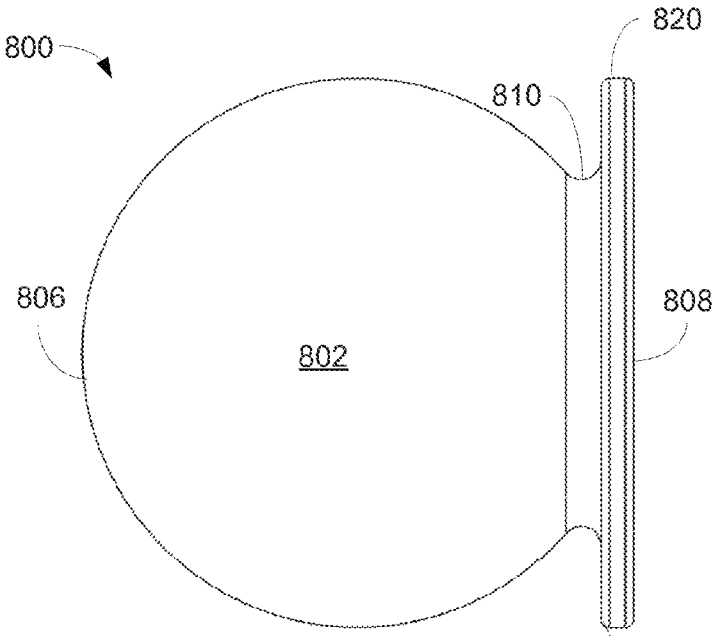


FIG 8A

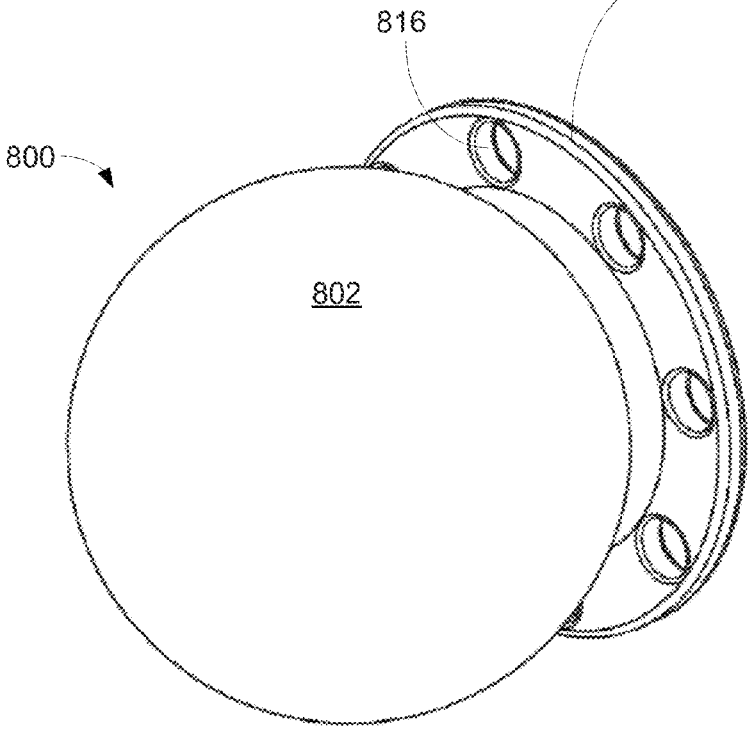


FIG. 8B

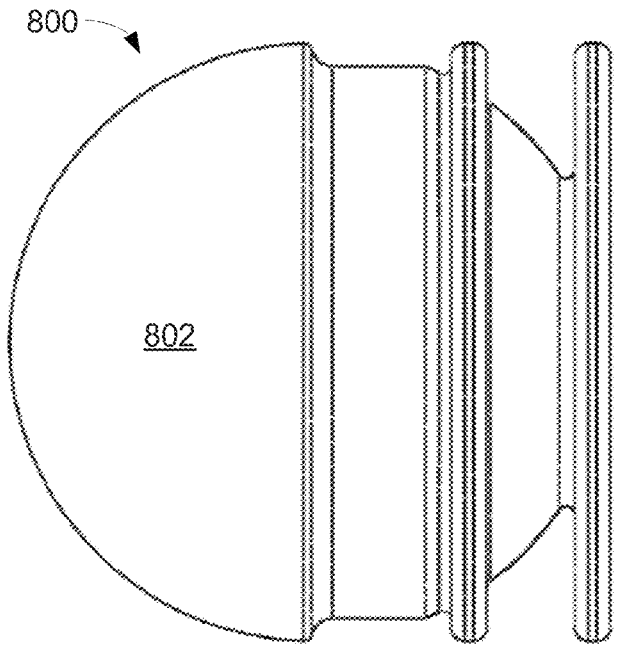


FIG 8C

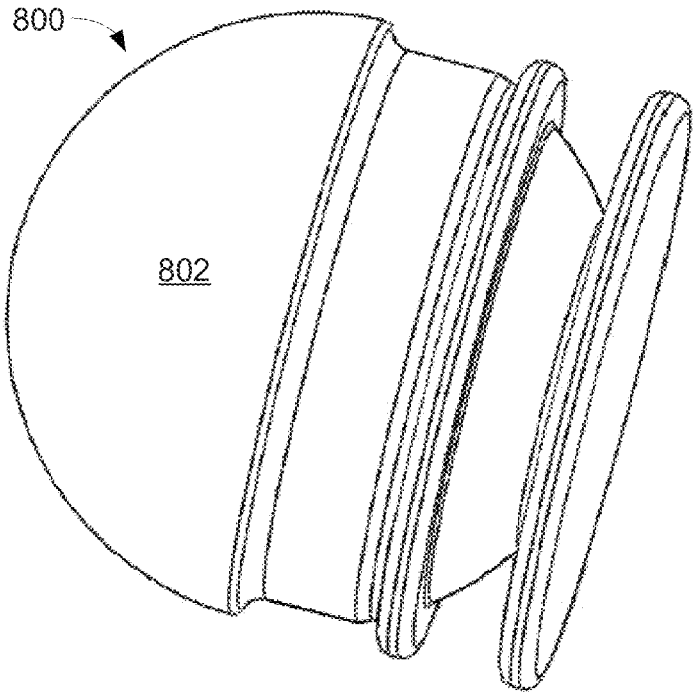


FIG 8D

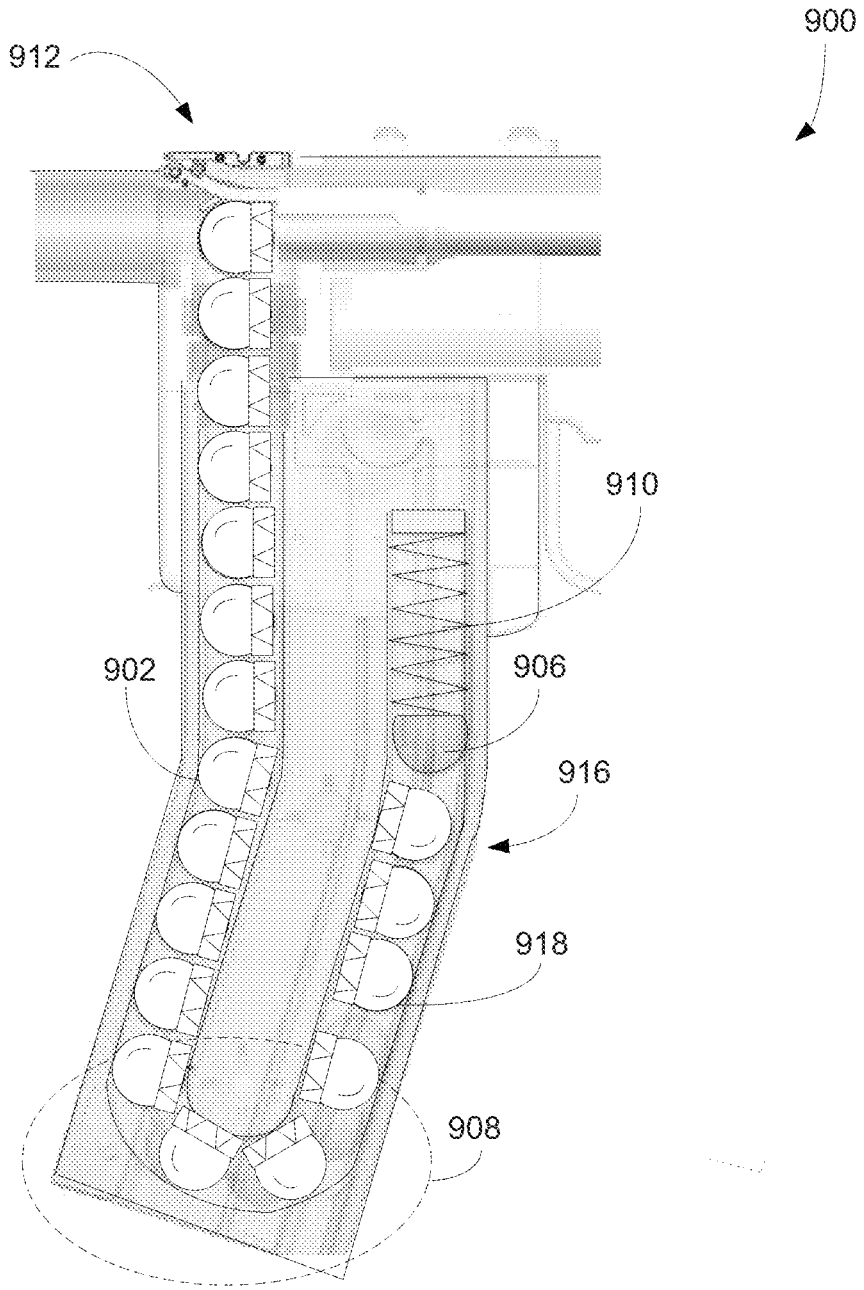


FIG 9

DELIVERY SHELL USING GYROSCOPIC GUIDING SYSTEM AND METHODS OF MAKING THE SAME

FIELD

The present invention relates to projectiles carrying payloads capable of being propelled by launch systems or apparatus. More specifically, the present invention relates to ammunition capable of being launched by compressed gas guns.

BACKGROUND

With increasing applicability of projectile ammunitions launched by gas-powered guns, projectiles with enhanced accuracy and distance are in high demand. For example, gas-powered guns such as paintball guns loaded with various types of paintballs are often used in many different settings and environments, such as paintball tournaments, police and military trainings, special effects on movie shootings, riot controls, et cetera. A conventional gas-powered gun such as a paintball gun uses carbon dioxide (CO_2) or compressed air to propel ammunition such as a delivery shell or paintball from its chamber to a target or object via its barrel.

A delivery shell or a paintball typically carries colored paint or marker and it breaks upon a high speed impact. To accurately reach an intended target, both the design of projectile and the power of paintball guns are important factors.

SUMMARY

A projectile such as a paintball including a ball-shaped or dome-shaped capsule and a round-shaped disc for improving accuracy and range of the projectile using gyroscopic approach is disclosed. The ball-shaped capsule, in one embodiment, having a head and a tail portion is able to store and deliver colored marker upon an impact between the projectile and an object. The round-shaped disc is positioned at a location to allow a portion of the round-shaped disc to extend above outer surface of the capsule. The disc is able to catch at least a portion of airflow when the projectile travels through the air after launching. The round-shaped disc, in one example, leverages airflows to facilitate and/or maintain travel direction of the projectile.

Additional features and benefits of the exemplary embodiment(s) of the present invention will become apparent from the detailed description, figures and claims set forth below.

BRIEF DESCRIPTION OF THE DRAWINGS

Exemplary embodiment(s) of the present invention will be understood more fully from the detailed description given below and from the accompanying drawings of various embodiments of the invention, which, however, should not be taken to limit the invention to the specific embodiments, but are for explanation and understanding only.

FIGS. **1**A-B are diagrams showing a delivery shell or projectile having a capsule and a disc in accordance with one embodiment of the present invention;

FIGS. **2**A-C are three-dimensional ("3D") diagrams illustrating an exemplary disc having multiple blades in accordance with one embodiment of the invention showing;

FIG. **3** is a diagram illustrating a delivery shell having a groove configured for a driving band in accordance with embodiments of the present invention;

FIGS. **4**A-D are diagrams illustrating a delivery shell having a driving band in accordance with one embodiment of the present invention;

FIGS. **5**A-D are diagrams illustrating a delivery shell having a capsule with a dome-shaped head and cone-shaped body in accordance with one embodiment of the present invention;

FIGS. **6-7** are diagrams illustrating a delivery shell having movable fins in accordance with one embodiment of the present invention;

FIGS. **8**A-D are diagrams illustrating an alternative exemplary shell having a capsule and a disc in accordance with one embodiment of the present invention; and

FIG. **9** is a diagram illustrating a gas-powered gun able to receive a magazine having multiple delivery shells in accordance with one embodiment of the present invention.

DETAILED DESCRIPTION

Exemplary embodiment(s) of the present invention is described herein in the context of a method, system and apparatus of providing a delivery shell having a dome-shaped head portion and a disc capable of being launched by a gas-powered propelling system.

Those of ordinary skills in the art will realize that the following detailed description of the exemplary embodiment(s) is illustrative only and is not intended to be in any way limiting. Other embodiments will readily suggest themselves to such skilled persons having the benefit of this disclosure. Reference will now be made in detail to implementations of the exemplary embodiment(s) as illustrated in the accompanying drawings. The same reference indicators will be used throughout the drawings and the following detailed description to refer to the same or like parts.

References to "one embodiment," "an embodiment," "example embodiment," "various embodiments," "exemplary embodiment," "one aspect," "an aspect," "exemplary aspect," "various aspects," etc., indicate that the embodiment(s) of the invention so described may include a particular feature, structure, or characteristic, but not every embodiment necessarily includes the particular feature, structure, or characteristic. Further, repeated use of the phrase "in one embodiment" does not necessarily refer to the same embodiment, although it may.

In the interest of clarity, not all of the routine features of the implementations described herein are shown and described. It will, of course, be understood that in the development of any such actual implementation, numerous implementation-specific decisions may be made in order to achieve the developer's specific goals, such as compliance with application- and business-related constraints, and that these specific goals will vary from one implementation to another and from one developer to another. Moreover, it will be understood that such a development effort might be complex and time-consuming, but would nevertheless be a routine undertaking of engineering for those of ordinary skills in the art having the benefit of this disclosure.

Various embodiments of the present invention illustrated in the drawings may not be drawn to scale. Rather, the dimensions of the various features may be expanded or reduced for clarity. In addition, some of the drawings may be simplified for clarity. Thus, the drawings may not depict all of the components of a given apparatus (e.g., device) or method.

As used herein, the singular forms of article "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. Also, the terms "comprises" and/or "comprising," when used in this specification, specify the presence of stated features, integers, steps, opera-

tions, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof. The term "and/or" includes any and all combinations of one or more of the associated listed items.

A delivery shell such as a projectile or a paintball including a ball-shaped capsule and a round-shaped disc for facilitating accuracy of projectile travel direction is disclosed. The ball-shaped or substantial ball-shaped capsule, in one embodiment, having a head and a tail is able to store and deliver colored markers upon an impact between the projectile and an object. The round-shaped disc is positioned at a place to allow a portion of the round-shaped disc to extend above outer surface of the capsule. The disc is able to catch airflow when the shell is launched. The round-shaped disc, in one example, uses airflows to facilitate travel direction of the projectile.

FIG. **1**A illustrates a delivery shell **100** having a ball-shaped capsule and a round-shaped disc in accordance with one embodiment of the present invention. Shell **100** can also be referred to as a paintball, projectile, aerodynamic projectile, ammunition, and the like. Shell **100**, in one embodiment, includes a ball-shaped capsule **102** and a round-shaped disc **110**, wherein disc **110** is configured in such a way that it is able to couple to capsule **102** almost seamlessly. Note that capsule **102** and disc **110** can be fabricated together onto a single unit. It should be noted that the underlying concept of the exemplary embodiment(s) of the present invention would not change if one or more components (or elements) were added to or removed from shell **100**.

Capsule **102** has a head **108** and a tail **116** and has an approximately spherical or ball-shaped body. Depending on the applications, diameter **120** of capsule **102** should have a range of 0.40 to 0.75 inch or caliber. Inside of capsule **102** is hollow and is able to store or carry user defined substances, such as, but not limited to, non-lethal color marker, non-lethal payload, lethal payload, non-lethal chemical agent, combustible material, and the like. Depending on the payload, capsule **102** can be fabricated with stretchable semi-solid material, such as plastic, polymer, rubber, polyurethane, synthetic material, or a combination of plastic, polymer, rubber, polyurethane. Alternatively, capsule **102** can also be made by different synthetic as well as natural materials, such as plant/animal wax, paraffin wax, beeswax, and/or other biodegradable substances.

Disc **110** is configured to have a generally flat circular configuration, and it has a diameter **122** and a height **106**. Diameters **120** and **122**, in one example, are approximately the same. In one embodiment, disc **110** includes multiple blades or aerodynamic blades **124** wherein each of blades **124** has a blade tip edge, a blade body, and a blade exit edge. The blade tip edge, the blade body, the blade exit edge, and a portion of capsule surface form an air channel **104** for facilitating spinning motion for shell **100**. In one aspect, the exit edges have curved shapes, wherein portions of the exit edges are commonly joined at a flat base plane.

Shell **100**, in one embodiment, is a projectile capable of being launched by a paintball gun. Sell **100** includes a ball-shaped capsule **102** and round-shaped disc **110**. Capsule **102** having a head **108** and a tail **116** is able to store and deliver colored markers upon an impact with an object. Disc **110** is coupled to tail **116** of capsule **102** in such a way that it allows a portion of disc **110** to extend above outer surface of capsule **102** to catch airflow when shell **100** moves in the air. Disc **110** is able to leverage direction of airflows to facilitate or adjust travel direction of shell **100**. Disc **110**, in one example, includes a coupler, not shown in FIG. **1**A, having a concave surface configured to receive tail **116** of capsule **102**. The concave surface of the coupler contains an opening that allows a portion of tail **116** to pass through for coupling or seating.

During operation, upon impact with a targeted object, capsule **102** breaks and delivers the payload such as colored marker to an area in the vicinity of the impact. It should be noted that when shell **100** moves in the air after it is launched by a paintball gun, airflow, for instance, may pass through air channels **104** which induces spinning motion of shell **100**. The lift force, for example, may create a torque causing spinning motion for shell **100** with a spinning axis coincided with the travel direction (or forward motion). Note that the spinning motion increases the stability or gyroscopic guiding motion to shell **100** whereby accuracy for shell **100** to hit a target is enhanced.

To be compatible with ammunition cartridge and launchers, diameter **122** and height **106** of disc **110** can be adjusted. For example, diameter **122** is configured to have the approximately the same size as diameter **120** of capsule **102** and height **106** may be about the radius of capsule **102**. Depending on the applications, other shell dimensions may be used.

FIG. **1**B is a diagram showing a delivery shell **152** having a groove for housing a driving band in accordance with one embodiment of the present invention. Shell **152** is similar to shell **100** illustrated in FIG. **1**A except that shell **152** includes two grooves **156-158**. In one embodiment, grooves **156-158** are configured to allow two driving bands, not shown in figure, to fit onto grooves **156-158** to enhance efficiency for gas-powered launcher as well as provide gyroscopic stability. It should be noted that the underlying concept of the exemplary embodiment(s) of the present invention would not change if shell **152** contains one groove **156** or additional grooves are added.

A driving band, not shown in FIG. **1**B, is a circular strip capable of fitting into a predefined circular groove such as groove **156** of capsule **152**. Capsule **152** includes a circumferential groove **156** capable of receiving a driving band wherein a portion of the driving band extends above the surface of capsule **152** to catch at least a portion of airflow which will be used to guide the travel direction of shell **152**. Alternatively, when a shell with a driving band is loaded in the firing chamber, the driving band is able to seal at least a portion of space between the shell and the barrel to prevent gas leakage during the gas-powered launch.

FIGS. **2**A-C are three-dimensional ("3D") diagrams **200-204** illustrating an exemplary disc having multiple blades in accordance with one embodiment of the invention showing. Diagram **200** illustrates a disc viewing from a back angle showing a flat base plane **224** with an opening **226** and multiple blades **212**. Eight (8) blades **212** are shown in diagram **200** wherein a side of each blade **212** is attached or joined at flat base plane **224**. Diagram **200** shows airflow surface **216** associated with blades **212**. Diagram **202** illustrates a disc having a view of inner surface **222** used to attach to a capsule such as capsule **102**. Diagram **204** is a side view of disc showing airflow surface **216**.

Disc **200** includes eight (8) blades or aerodynamic blades **212**, wherein each blade has an airflow surface **216** and an inner surface **222**. Airflow surface **216** includes a blade tip **218**, an exit edge **220**, and a blade body wherein blade body is defined by an upper surface **230**, a lower surface **234**, and a side surface **232**. Side surface **132** joins upper surface **230** and lower surface **234** and extends to exit edge **220**. Note that blade exit edge **220**, blade tip **218**, blade body, and a portion of capsule surface form an air channel. When airflow travels through airflow surface **216**, the curvature of blade **212** allows airflow to generate spinning motion for the shell or projectile.

Note that exit edges **220** of blades **212** have curved shapes and are commonly joined to flat base plane **224**. It should be noted that disc and capsule can be manufactured together as a single unit.

Each blade **212** is configured to have an aerodynamic shape for reducing air drag while redirecting airflow to generate spinning motion. Blades **212** as shown in FIG. **2**A are spaced in equal distance for creating air channels between two adjacent blades **212**. Upper surface **230** and lower surface **234** are converged at downstream of airflow to form exit edge **220**. Airflow surface **216** uses its aerodynamic surface to generate spinning force when the air stream passes over surface **216**.

Inner surface **222** is configured to seat at least a portion of capsule such as a tail end of capsule **102** shown in FIG. **1**A. Note that the capsule is not limited to a spherical or ball shape capsule and it, for example, can be an elongated spherical or ellipsoid shaped capsule. It should be further noted that when the capsule is not spherical, inner surface **122** may be adjusted to the contours of capsule for coupling purposes. In one aspect, inner surface **222** is configured to have a contour closely matching with surface contour of capsule.

When a shell travels through the air, airflow surface **216** is shaped in such a way that it catches a portion of air stream. For example, when air stream passes through upper surface **230** and lower surface **234**, different air pressures between the surfaces are exerted whereby a torque is induced. The torque introduces spin motion for the shell. It should be noted that blades **212** are arranged in a circular formation and they can cause the shell to spin in a direction indicated by arrow **228**. The spin motion is created around an axis parallel to travel direction of shell through the air.

FIG. **3** is a diagram illustrating a delivery shell **300** having a groove or grooves configured to house a driving band(s) in accordance with embodiments of the present invention. Shell **300** includes capsule **152** which is illustrated in FIG. **1**B and disc **200** which is illustrated in FIG. **2**A. Capsule **152** is coupled with disc **200** to form a delivery shell wherein disc **200**, in one example, uses a set of blades to provide gyroscopic stability to improve accuracy of hitting the target. Depending on the applications, one or two driving bands can be installed in grooves **304**. It should be noted that the installed driving band(s) will be situated approximately perpendicular to the travel direction of shell **300** as indicated by arrow **320**. A function of driving band is that it further provides gyroscopic stability to improve accuracy and range. Another function of driving band is that it prevents gas leakage to the barrel during the launch process. Note that capsule **152** and disc **200** can be fabricated on a single unit.

FIGS. **4**A-D are diagrams illustrating a delivery shell having a driving band(s) in accordance with one embodiment of the present invention. FIG. **4**A illustrates a delivery shell **400** having capsule **402**, disc **200**, and two driving bands **410** capable of being launched by a paintball gun. Capsule **402**, in one embodiment, has a round-shaped vessel capable of storing and delivering colored marker upon breakage of the vessel. In an alternative embodiment, Capsule **402** includes a dome-shaped head and a conical body configured to store and delivery colored marker upon breakage of the capsule.

Disc **200** having a propeller-shaped tail portion is coupled to capsule **402**. The propeller-shaped tail portion includes a set of curved blades which have aerodynamic surfaces capable of forming air channels between the curved blades and surface of capsule **402**. The air channels, in one example, guide airflows when the projectile is launched and travels through the air. Note that the set of curved blades facilitates or generates spin motion for the projectile or shell **400** whereby the accuracy of projectile to hit a target is enhanced.

Driving bands **410**, in one embodiment, are manufactured in circular rings with relatively flexible materials. Driving bands **410** are configured to fit into the installing grooves **410**. The outer diameter of driving band **410** is configured to approximately match the bore diameter of the barrel of the projectile launcher or paintball gun. A function of driving bands **340** is to provide a seal effect between shell **400** and the wall of barrel to prevent or reduce gas leakage to the barrel during the launch. Single band may be used. In one embodiment, driving band **410** may be opening rings.

A spinning track, in one aspect, is imprinted on the wall of barrel for creating a spinning motion of shell inside of barrel as the shell moves from the firing chamber to the opening of barrel. The spinning track receives a portion of driving band **410** and uses driving band **410** to spin shell **400** as shell **400** travels through the barrel. An advantage of using a driving band is that it improves compression ability and launch efficiency with gas-powered guns. Another advantage of using a driving band is to provide gyroscopic stability to enhance accuracy and range. In one embodiment, the driving band is made of biodegradable materials, such as expanded corn foams, wheat, sugar, wood, or the like.

FIG. **4**B is a diagram illustrating a paintball gun including a barrel **452**, a delivery shell **400**, and a gas-powered propeller **450** capable of using a driving band **410** in accordance with one embodiment of the present invention. Shell **400** is loaded to a firing or launch chamber wherein the top or outer portion of driving band **410** touches the inner wall **454** of barrel **452** to reduce or minimize gas leakage from propeller **450** into barrel **452** during the launch. During operation, when propeller **450** releases gas or CO2, shell **400** moves from the launch chamber toward the opening of barrel **456** in a direction indicated by numeral **458**. It should be noted that the driving band **410** improves the efficiency of gas-powered launch whereby driving band increases range of shell **400**.

FIG. **4**C is diagram illustrating a paintball gun including a barrel **452**, a delivery shell **400**, and a gas-powered propeller **450** capable of using a driving band **410** for spinning in accordance with one embodiment of the present invention. In one embodiment, barrel **452** includes a spiral track or spinning track **462** wherein spiral track **462** is able to house driving band **410**. When propeller **450** releases gas or CO2, shell **400** moves from the launch chamber toward the opening of barrel **456** in a direction indicated by numeral **458**. Since driving band **410** is fitted with spiral track **462**, track **462** causes shell to spin inside of barrel **452** with a direction indicated by numeral **460**. It should be noted that the driving band **410** causes shell **400** to spin before it leaves barrel **452** to create a gyroscopic stability for accuracy enhancement.

FIG. **4**D is a diagram illustrating a paintball gun including a barrel **452**, a delivery shell **400**, and a gas-powered propeller **450** capable of using a driving band **410** in accordance with one embodiment of the present invention. Once shell **400** leaves barrel **452**, driving band **410**, in one embodiment, begins to create a fire or combustion **470** having a burning effect. Driving band **410** not only provides a gyroscopic stability, but also provides a fire ball. Generating a fire ball effect can be helpful to create special effects for movie shootings. Other applications are possible. For example, fire delivery by shell **400** may be useful to provide fire control during a wildfire. Alternatively, driving band **410** can also deliver a sound effect such as whistling or playing music **472** as shell **400** flying or traveling through the air. It should be noted that depending on the applications, any number of driving bands may be used.

FIGS. **5**A-D are diagrams illustrating a delivery shell having a capsule with a dome-shaped head and cone-shaped body

in accordance with one embodiment of the present invention. FIG. **5**A illustrates a delivery shell **500** having capsule **502** and disc **200** capable of being launched by a paintball gun. FIG. **5**B illustrates shell **500** having a back angle view showing disc **200**. Capsule **502**, in one embodiment, has a round-shaped vessel capable of storing and delivering colored marker upon breakage of the vessel. In an alternative embodiment, Capsule **502** includes a dome-shaped head and a conical body configured to store and delivery colored marker upon breakage of the capsule. In one embodiment, shell **500** has a groove **504** capable of housing a driving band.

Disc **200** having a propeller-shaped tail portion is coupled to capsule **502**. The propeller-shaped tail portion includes a set of curved blades which have aerodynamic surfaces capable of forming air channels between the curved blades and surface of capsule **502**. The air channels, in one example, guide the airflows when the projectile is launched and travels through the air. Note that the set of curved blades facilitates a spinning motion for the projectile or shell **500** to enhance the accuracy of the projectile to hit a target.

Depending on the applications, various size or dimension of shell **500** may be fabricated. For example, to make shell **500** compatible with various types of existing launcher equipments, shell **500** may be configured to have height **506** of disc to be approximately the same as diameter **508** of capsule **502**.

FIG. **5**C is a 3D cross-sectional diagram **550** illustrating an exemplary internal structure of shell **500** having a dome-shaped head and a conical or cone-shaped body. For example, diagram **550** shows shell **500** containing a cavity **560** wherein cavity **560** is enclosed by a spherical dome-shaped base **562** and a conical body **564**. The vertex of conical body **564**, for instance, is coupled to base **224** of disc **200**. Cavity **560** is capable of carrying lethal payload such as explosives or chemical/biological agents. Alternatively, cavity **560** is able to carry non-lethal content such as marking dye and/or paint. The vertex of the conical body **564**, in one example, maybe truncated and can be opened through base **224** to provide access to cavity **560**.

FIG. **5**D is a 3D diagram illustrating an alternative embodiment of shell **508** having a dome-shaped head and a conical or cone-shaped body. Shell **508** includes multiple grooves **550** capable of housing up to four driving bands. It should be noted that one driving band can installed at disc **200**.

FIGS. **6-7** are diagrams illustrating a delivery shell having movable fins in accordance with one embodiment of the present invention. FIG. **6**A illustrates a shell **600** having four foldable blades or movable fins **616** wherein shell **600** is in an operation position. The operation position means all movable fins are fully extended for catching pass-by airflow to make shell **600** to spin when it is launched in the air. FIG. **6**B illustrates shell **600** which is in a folding position before it is being launched. When movable fins **616** are in a closed position or folding position, fins **616**, in one aspect, are contained inside an outer perimeter of annular base **632**. FIG. **6**C is a side view of shell **600** in folding position. FIG. **6**D is a side view of shell **600** in operation position.

Shell **600**, in one embodiment, includes a capsule **602**, an annular base **632**, pivot pins **640**, and movable fins **616**. Capsule **602** having a round head and a conical body is capable of storing and delivery payload such as colored marker upon breakage of capsule **602**. Annular base **632** has an opening which is configured to allow a portion of capsule **602** to pass through such as a portion of the conical body. Pivot pins **640** are configured to anchor to annular base **632**, and movable fins **616** are coupled to pivot pins **640**. In one example, movable fins form a foldable curved propeller having four twisted blades able to form a substantially circular column around a cylindrical body **618** of annular base **632** before shell **600** is launched into air stream.

Movable fins **616**, in one embodiment, are used to enhance accuracy and/or travelling distance of shell **600**. Movable fins **616** can be configured as four twisted blades, wherein each blade has a helical surface **620-622** capable of generating a force in response to airflow that passes through the helical surface. When shell **600** is launched into the air stream, movable fins pivot open in operation position or mode capable of facilitating to cause or assist a spinning motion for shell **600**. In one example, movable fins **616** are able to extend beyond the circumferential boundary of annular base **632** when they are in operation position. Alternatively, when movable fins **616** are in folding position, movable fins **616** are contained within a circumferential boundary of annular base **632**.

Referring back to FIG. **6**A, shell or projectile **600** includes a dome-shaped capsule **602**, a circumferential groove **646** adjacent to capsule **602** and a tail portion **610**. Tail portion **610** is attached to annular base **632** next to circumferential groove **646**. Dome-shaped capsule **602** may be used to carry lethal content such as explosives. Alternatively, capsule **602** is configured to carry non-lethal content such as marking dyes. Tail portion **610** includes cylindrical body **612**, movable fins **616**, and pivot pins **640**. The diameter of cylindrical body **612**, in one example, is smaller than the diameter of dome-shaped capsule **602**. Cylindrical body **612**, in one example, is connected to a center region of annular base **632**. Cylindrical body **612**, in one aspect, includes a right circular cylinder **614** and an open-ended, truncated circular cone **618** which is attached to a side of cylinder **614** opposite to annular base **632**. The open-ended, truncated circular cone **618** provides an access for entering internal space of dome-shaped capsule **602**. An access port **626** may be constructed to serve as an entry to the internal of shell **600**.

Movable fin **616** includes a fin body **624** having a top flow surface **620** and a lower flow surface **622**, and a pivoting base **630** connected to fin body **624**. Top flow surface **620** and lower flow surface **622** are aerodynamic surfaces. Pivoting base **630** contains a pivot hole **642** for engaging with a pivot pin **640**. Pivot pins **640** are attached to annular base **632** and are situated at equal or the same distance from cylindrical body **612**. Pivot pins **640** are also equally spaced circumferentially in annular base **632**. Movable fins **616** are pivotally attached to pivot pins **640** through pivot holes **642** in pivoting base **630**. Fin **616** is in operation position when fin body **624** pivots away from cylindrical body **612**. Fin **616** is in folding position when fin body **624** pivots to toward cylindrical body **612**.

Pivot hole **642** and pivot base **630** are shaped in such a way that when fins **616** pivot to a desired operation position, a locking between fins **616** and cylindrical body **612** is created to prevent any further opening movement of the aerodynamic fins **616**. Pivot hole **642**, in one example, is an oblong shaped hole which allows fin **616** to move in a circumferential direction of annular base **632** while swiveling around pivot pin **640**. In one aspect, a spring such as a torsional spring may be used to open fins **616** between pivot pin **640** and pivoting base **630**. The torsional spring is in a winded state when fins **616** are in folding position or in closed status.

FIGS. **6**E-F are 3D diagrams showing a delivery shell **600** with a driving band **650** in accordance with one embodiment of the invention. Capsule **602** further includes a circular ring installed in a circular circumferential undercut groove between the hemispherical capsule and the annular base. FIGS. **6**E and F illustrate shell **600** having a dome-shaped capsule **602**, a tail portion, and movable fins **616** wherein fins **616** are in a folding position. FIG. **6**G illustrates a shell **600** in

the operation position with a driving band **650**. When shells **600** are stored or loaded in a projectile launcher, fins **616** are in closed or folding position as shown in FIGS. **6**E and F. Fins **616**, in one example, remain in folding position until shell **600** is launched. When shell **600** leaves the barrel of a launcher, fins **616** swing open in operation position as shown in FIG. **6**G. As shell **600** travels toward a target with a direction indicated by arrow **654**, air flows over the surface of dome-shaped capsule **602** to tail portion **610** via driving band **650**. The airflow generates a force via band **650** and movable fins **616** to cause shell **600** to spin.

FIG. **6**H illustrates an alternative embodiment of a delivery shell having a capsule **688** and a disc **698** in accordance with one embodiment of the invention. Diagrams **680**-**686** illustrate an exemplary process of changing shell's physical configuration as it is being launched by a gas-powered launcher such as a paintball gun. Diagram **680** illustrates a shell in a folding position. When the shell is in folding position, it has a dimension that will fit for any standard loading magazines before launching. Diagram **682** illustrates the shell has been launched from the firing chamber. As the shell moves through the barrel, capsule **688** extends a portion of its body as indicated by numeral **690**. As soon as the shell exits the barrel, a portion of movable fins swings open as indicated by numeral **692** as shown in diagram **684**. After movable fins are in operation position, the movable fins move along pivot pin away from capsule **688** as indicated by numeral **696** in diagram **686**. When capsule **688** is extended and movable fins are in their full operation mode, extended capsule **688** and disc **698** with movable fins optimize weight distribution of shell as well as structural balanced whereby shell's accuracy and distance can be improved.

FIG. **7** is a two-dimensional ("2D") cross-sectional diagram **700** illustrating an exemplary internal structure of delivery shell or projectile **600** in accordance with one embodiment of the invention. Diagram **700** shows shell **600** having a capsule **602** wherein capsule **602** contains a cavity **660**. Cavity **660**, in one embodiment, includes a dome-shaped base **664** and a conical shaped body **662**. In one embodiment, cavity **660** is used to contain lethal agent such as explosive or chemical agents. Alternatively, cavity **660** carries non-lethal content such as marking dyes or paint. An access port **626** is located at the vertex of cone-shaped cavity **660**. Port **626** is accessible via the opening of truncated cylindrical body **618**. During fabrication, access port **626** may be used to load material such as marking dyes into cavity **660**. In one example, the height **710** of shell **700** is equal or approximately equal to the diameter **712** of capsule **602**.

FIGS. **8**A-D are diagrams illustrating an alternative exemplary shell **800** having a capsule and a disc in accordance with one embodiment of the present invention. Shell **800**, in one embodiment, includes a ball-shaped capsule **802** and a round-shaped disc **820**. Shell **800** is capable of being launched by a paintball gun. Ball-shaped capsule **802** has a head **806** and a tail **808**, and is hollow inside able to store and deliver colored markers upon an impact with an object. Round-shaped disc **820** is coupled to tail **808** of capsule **802** and is configured to position disc **820** to a location so that it allows a portion of round-shaped disc **820** to extend above outer surface of capsule **802**. Disc **820** is able to catch at least a portion of airflow when shell **800** moves through the air. Disc **820** is able to utilize direction of the airflow to facilitate the travel direction of shell **800**.

Disc **820** further includes a coupler **810** having a concave surface configured to receive tail **808** of capsule **802**. A guiding ring **812** which can be part of disc **820** is coupled to coupler **810**. Guiding ring **812**, in one embodiment, has multiple openings **816** allowing air to pass through for guiding travel direction of the projection. Openings **816** of guiding ring **812** are configured to facilitate spinning motion of shell **800**. The spinning motion, in one aspect, enhances travel distance and accuracy of projectile direction. The concave surface of coupler **810** contains a hole (not shown in figure) that allows a portion of tail **808** of ball-shaped capsule **802** to pass through.

FIGS. **8**C-D are diagrams illustrating an alternative exemplary shell **800** having a capsule capable of housing driving band(s), and a disc.

FIG. **9** is a diagram **900** illustrating a gas-powered gun able to receive a magazine having multiple delivery shells in accordance with one embodiment of the present invention. Diagram **900** includes a projectile or shell propelling system **912** and a magazine **916**, wherein magazine **916** further includes a U-shaped storage channel **918**, a follower **906**, and a spring **910**. The U-shaped storage channel **918** is able to house multiple projectiles or shells **902** wherein shells **902** are pushed or managed by follower **906** mounted at one end of spring **910**. When magazine **916** is loaded with shells **902**, all of shells, projectiles, or paintballs **902** travel through U-shaped storage channel **918** before they are being launched. It should be noted that dimension **908** of U-shaped storage channel **918** can and should change according to types of ammunition used. An advantage of using the magazine illustrated in diagram **900** is to maximize the usage of available space in the magazine.

Shells **902**, in one embodiment, are similar to shell **100** shown in FIG. **1**A, shells **300** shown in FIG. **3**, shells **400** shown in FIG. **4**A, shells **500** shown in FIG. **5**A, shells **600** shown in FIG. **6**A, or shell **800** shown in FIG. **8**A. Alternatively, storage space in magazine **916** may include one straight storage column or two straight storage columns instead U-shaped storage channel **918**. It should be noted that delivery shells capable of delivery payload are configured with certain dimensions whereby they can be launched by existing launch equipments such as gas-powered paintball guns.

While particular embodiments of the present invention have been shown and described, it will be obvious to those of ordinary skills in the art that based upon the teachings herein, changes and modifications may be made without departing from this exemplary embodiment(s) of the present invention and its broader aspects. Therefore, the appended claims are intended to encompass within their scope all such changes and modifications as are within the true spirit and scope of this exemplary embodiment(s) of the present invention.

What is claimed is:

1. A projectile capable of being launched by a paintball gun, comprising:

a substantial ball-shaped capsule having a head and a tail, and able to store and deliver colored marker upon an impact with an object; and

a round-shaped disc coupled to the tail of the capsule and configured to position the round-shaped disc so that allowing a portion of the round-shaped disc to extend above outer surface of the capsule to catch at least a portion of airflow that flows from the head of the capsule when the projectile is moving, wherein the round-shaped disc is able to utilize direction of the airflow to facilitate travel direction of the projectile, wherein the round-shaped disc is configured to include a plurality of blades, wherein each of the plurality of blades has a blade tip edge, a blade body, and a blade exit edge, wherein the blade tip edge, the blade body, the blade exit edge, and a portion of capsule surface form an air chan-

nel for facilitating spinning motion of the projectile, wherein the exit edges of the plurality of blades have curved shapes, wherein portions of the exit edges are commonly joined at a flat base plane.

2. The projectile of claim **1**, wherein the round-shaped disc includes:

a coupler having a concave surface configured to receive the tail of the capsule.

3. The projectile of claim **2**, wherein the round-shaped disc is configured to facilitate spinning motion of the projectile to enhance travel distance and accuracy of projectile direction.

4. The projectile of claim **3**, wherein the spinning motion of the round-shaped disc provides a gyroscopic stability to improve accuracy and distance of the projectile.

5. The projectile of claim **2**, wherein the concave surface of the coupler contains a hole allowing a portion of the tail of ball-shaped capsule to pass through.

6. The projectile of claim **1**, wherein the round-shaped disc further includes a plurality of angular shaped protruding fins configured to catch airflow.

7. The projectile of claim **6**, wherein the plurality of angular shaped protruding fins facilitates a spinning motion of the round-shaped disc when airflow flows between the plurality of angular shaped protruding fins.

8. A paintball comprising:

a capsule having an ellipsoid shaped body capable of storing and delivery colored marker upon breakage of the capsule;

an annular base having an opening which is configured to allow a portion of the capsule to pass through so that allowing a portion of the annular base to extend above outer surface of the capsule to catch airflow which flows from the capsule to the portion of the annular base when the paintball travels through air, wherein the annular base directs the airflow to provide guidance of paintball travel direction, wherein the annular base includes blades, wherein each of the blades has a blade tip edge, a blade body, and a blade exit edge, wherein the blade tip edges, the blade bodies, the blade exit edges, and a portion of capsule surface facilitate spinning motion of the paintball, wherein the exit edges have curved shapes and are commonly joined at a base.

9. The projectile of claim **8**, wherein the annular base includes a coupler having a concave surface configured to receive a portion of the capsule.

10. The projectile of claim **9**, wherein the annular base generates a plurality of airflows for guiding travel direction of the projection.

11. The projectile of claim **9**, wherein the concave surface of the coupler contains a hole allowing a portion of the tail of ball-shaped capsule to pass through.

12. The projectile of claim **8**, wherein the annular base is configured to facilitate a spinning motion of the projectile to enhance travel distance and accuracy of projectile direction.

13. The projectile of claim **8**, wherein the annular base includes a plurality of curved blades, wherein the plurality of curved blades includes aerodynamic surfaces capable of forming air channels between the plurality of curved blades and surface of the capsule.

14. A projectile capable of being launched by a paintball gun, comprising:

a substantial ball-shaped capsule having a head and a tail, and able to store and deliver colored marker upon an impact with an object; and

a round-shaped disc coupled to the tail of the capsule and configured to position the round-shaped disc so that allowing a portion of the round-shaped disc to extend above outer surface of the capsule to catch at least a portion of airflow when the projectile is moving, wherein the round-shaped disc includes a plurality of blades, wherein each of the plurality of blades has a blade tip edge, a blade body, and a blade exit edge wherein the blade body is wider than the blade tip edge which is able to guide direction of the airflow from the head of the capsule, wherein the exit edges of the plurality of blades are configured to have curved shapes, wherein the round-shaped disc is configured to facilitate a spinning motion of the projectile to enhance travel distance and accuracy of projectile direction.

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